SHEAR WAVE ELASTOGRAPHY FOR THYROID NODULES

Sebag F, Vaillant-Lombard J, Berbis J, Griset V, Henry JF, Petit P, Oliver C. Shear wave elastography: a new ultrasound imaging mode for the differential diagnosis of benign and malignant thyroid nodules. J Clin Endocrinol Metab 2010;95:5281-8.

SUMMARY • • • • • • • • •

BACKGROUND

Thyroid elastography is an ultrasonographic technique to evaluate the stiffness of a thyroid nodule as an indicator of whether it is benign or malignant. It is based on the assumption that malignant nodules are stiffer than benign lesions. Shear wave elastography is a new technique that provides an objective assessment of the stiffness of a lesion.

METHODS

The authors used shear wave elastography and conventional ultrasound to evaluate nodules in 93 patients; 61 patients had a solitary nodule and 32 had multiple nodules. Subclinical hyperthyroidism was found in 5 patients and subclinical hypothyroidism in 3; 79 patients had thyroid surgery, including all of those with multinodular goiter and 47 of the 61 with single nodules. There was an additional control group with normal thyroid function who underwent ultrasonography and elastography. (The authors did not state whether fine-needle aspiration (FNA) of the nodules was performed.) The ultrasound machine that was used in the study was developed by SuperSonic Imagine (Les Jardins de la Duranne, Aix-en-Provence, France). It uses pushing beams to generate a shear wave and then calculates an elasticity index in kilopascals (kPa). It also displays an image in which softer tissue is blue and stiffer tissue is red.

RESULTS

Fifteen of the solitary nodules were malignant and 8 of those with multinodular goiter had 14 separate carcinomas. The ultrasound features predictive of

malignancy were hypoechogenicity (sensitivity, 70%; specificity, 82%), absent halo sign (sensitivity, 93%; specificity, 41%), microcalcifications (sensitivity, 67%; specificity, 85%), and intranodular vascularity (sensitivity, 52%; specificity, 94%). The presence of dense macrocalcifications >2 mm was not predictive of malignancy, with a sensitivity of 22% and a specificity of 79.6%.

The mean (±SD) elasticity index was significantly higher in malignant nodules (150±95 kPa [95% confidence interval {CI}, 30 to 356]) than in benign nodules (36±30 [95% CI, 0 to 200]) and normal thyroid glands (15.9±7.6 [95% CI, 5 to 35]) (P<0.001).

For a positive predictive value of at least 80%, the cutoff level of the elasticity index for malignancy was estimated as 65 kPa. The elasticity index was <65 kPa (negative) in three papillary thyroid carcinomas and one follicular tumor of uncertain malignant potential. It was >65 kPa in all follicular carcinomas and in the one medullary and one anaplastic carcinoma.

Table 1 shows the sensitivity, specificity, and positive and negative predictive values for detection of malignancy in the nodules evaluated by shear wave elastography, ultrasound, or the combination of both methods.

CONCLUSIONS

The authors recommend shear wave elastography as the first-line procedure for evaluation of thyroid nodules. When the value is >65 kPa, FNA should be performed, and if <65 kPa, the decision for FNA may be based on other ultrasound characteristics.

TABLE 1. Sensitivity, Specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) for Diagnosis of Malignancy in Thyroid Nodules by Shear Wave Elastography (SWE), Ultrasound, or the Combination of Ultrasound and SWE.

Variable	SWE	Ultrasound	Ultrasound + SWE	
	%	% (95% confidence interval)		
Sensitivity	85 (72–99)	52 (73-91)	82 (67–96)	
Specificity	94 (89–99)	97 (94–100)	97 (94–100)	
PPV	80 (65–95)	82 (64–100)	88 (75–100)	
NPV	96 (92–100)	88 (82-94)	95 (91–99)	

COMMENTARY • • • •

As of this writing, elastography has been reported in 22 papers in the English literature for evaluation of thyroid nodules since the first paper using this method by a Japanese group in 2005 (1). Recently. real-time elastography, in which elasticity was graded 1 to 3, where lower numbers denoted greater elasticity, was found to be useful in further evaluation of nodules that were indeterminate or nondiagnostic on FNA. The malignant nodules were stiffer (grades 2 or 3) and the benign nodules were more elastic (grade 1) (2), but this method is very dependent on the operator. In contrast with static elastography, the results of shear wave elastography are not dependent on the operator, and they are

reported to be reproducible and quantitative. The result is not altered by a hard area in the vicinity of the nodule of interest. However, elastography may not be useful in the presence of coarse calcifications because the calcifications are stiff, causing a false positive rate as high as 25%. The technique may be especially valuable in the diagnosis of follicular thyroid cancers because these cancers often lack the ultrasound features of papillary thyroid cancer and they usually cannot be diagnosed with precision by FNA. As the authors state, large prospective studies of shear wave elastography will be needed to confirm these results and to determine the true utility of this procedure in the evaluation of thyroid nodules.

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References

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